Going End to End to Deliver High-Speed Data

Originating Technology/ NASA Contribution

By the end of the 1990s, the optical fiber "backbone" of the telecommunication and data-communication networks had evolved from megabits-per-second transmission rates to gigabits-per-second transmission rates. Despite this boom in bandwidth, however, users at the end nodes were still not being reached on a consistent basis. (An end node is any device that does not behave like a router or a managed hub or switch. Examples of end node objects are computers, printers, serial interface processor phones, and unmanaged hubs and switches.)

The primary reason that prevents bandwidth from reaching the end nodes is the complex local network topology that exists between the optical backbone and the end nodes. This complex network topology consists of several layers of routing and switch equipment which introduce potential congestion points and network latency.

By breaking down the complex network topology, a true optical connection can be achieved. Access Optical Networks, Inc., is making this connection a reality with guidance from NASA's nondestructive evaluation experts.

Partnership

Naperville, Illinois-based Access Optical is a fabless semiconductor and optical component subsystem manufacturer. (Fabless refers to a company that does not manufacture its own silicon wafers and concentrates on the design and development of semiconductor chips.) It develops and delivers value-added, high-speed, optical-to-digital transducers that directly connect digital computers to local area networks (LAN) and wide area networks (WAN), as well as metro and long haul networks. These products provide true end-to-end optical connections between server, database host, and LAN domains as high-speed peripheral devices.

Access Optical Networks, Inc.'s end-to-end optical technology not only allows a server to tie directly to an optical area network, but also offloads Internet protocol stack operations. This provides a significant improvement in server performance by freeing up central processing unit (CPU) cycles, reducing system interruptions, and eliminating memory overhead and processor latency.

While searching for opportunities to run proof-of-concept tests on a new router/switch optical memory storage system, Access Optical encountered a team of nondestructive evaluation researchers at NASA's Glenn Research Center. These researchers saw that the high-speed, multi-gigabit and multi-terabit data-transfer capabilities of Access Optical's storage system had potential to enhance a laser-holographic technique they use; this technique involves neural networks to analyze patterns in holographic images. Such data-intensive computation can be a slow process, but the company's technology showed promise in speeding up the analysis and improving output.

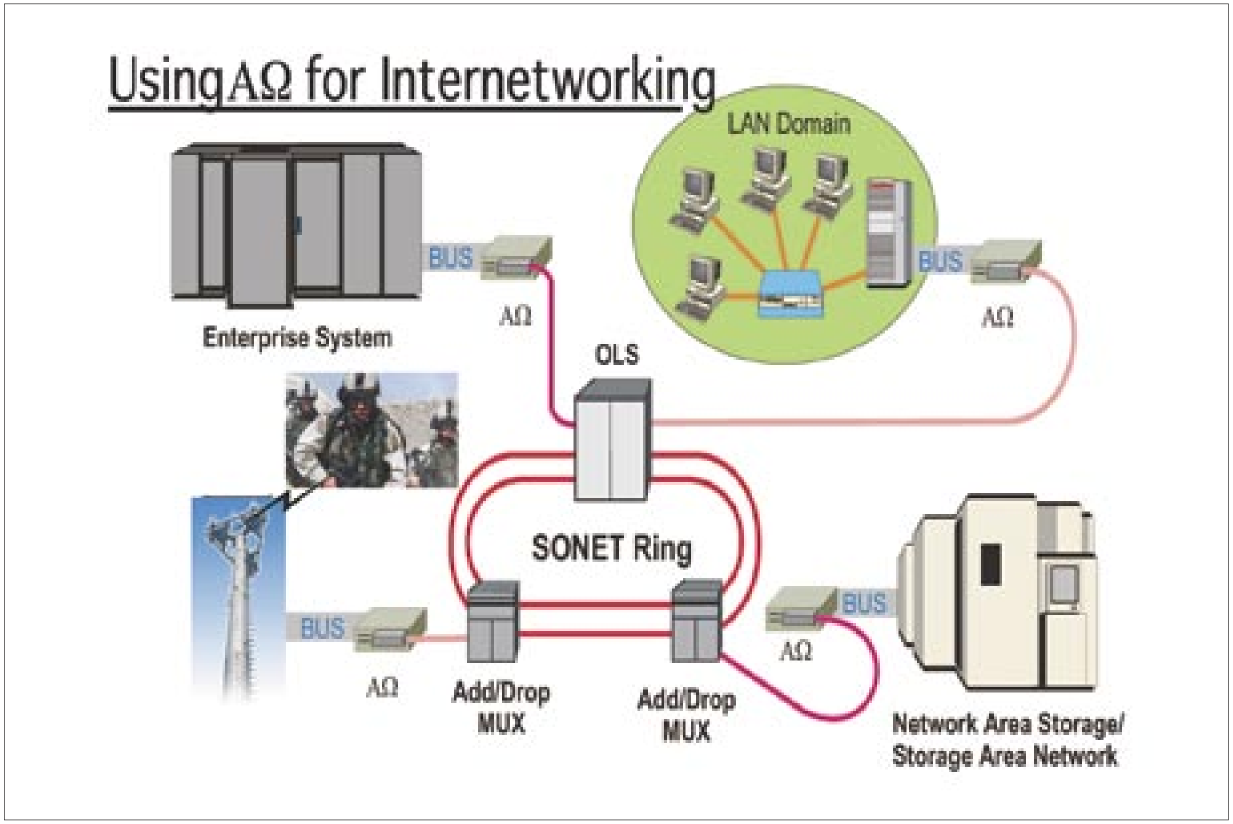
An award from the NASA Illinois Commercialization Center—Glenn's link to Illinois businesses—helped initiate the partnership between Access Optical and Glenn, so that the new technology could be proof-tested with help from the nondestructive evaluation team. For Access Optical, this "technology fusion experiment" with NASA provided a specific application on which to focus its efforts, valuable insight into product modifications and product integration, and the financial means to expand as a successful company.

NASA is now looking at Access Optical's high-speed data-processing capability for application in other areas, especially those supporting the Vision for Space Exploration.

Product Outcome

Now a concept turned reality, Access Optical's Alpha-Omega (AΩ) family of optical peripheral equipment resolves data rate mismatches between high-speed optical carrier-grade networks and the digital computer bus interfaces with high-speed, high-density shared memory, and simple bus protocols. According to the company, these resolutions can be achieved at a cost that is 60-percent lower than competitor solutions.

The AΩ optical peripheral units are platform computer interface products with interchangeable network interface



Access Optical Networks, Inc.'s next-generation access point solution.

cards for optical SONET (Synchronous Optical Network Technologies) or optical Ethernet protocol network connections. Currently, corporate servers and computer interfaces rely on disbursement networks, which consist of several layers of routing and switching equipment, to gain access to Ethernet and SONET long haul networks. These disbursement networks add several "hop" junctures and introduce congestion points, thus, diminishing bandwidth. With the AΩ units, bandwidth is increased, disbursement networks are flattened, and congestion points are eliminated.

Access Optical's AΩ products also perform routing functions that allow customers to configure point-to-point and point-to-multipoint transmissions using ring and mesh network topologies. Such configurations translate into peer-to-peer server, workstation, and client/server sub-networks directly connected or seamlessly interconnected via LAN/WAN, metro, and/or long haul networks. Consequently, the devices provide maximum utilization of bandwidth between computers connected via communication networks while eliminating the need for intermediate network equipment (e.g., routers, asynchronous transfer modes, and cross-point switches) to aggregate data traffic and manage intermediate communication protocols. They use a single protocol over a broad range of megabits and terabits that scales to meet the customer's need to change or grow the capacity of their network.

The AΩ technology provides maximum benefits to customers who have high-capacity streaming data applications, such as Wavelength Services, Storage Area Network (SAN)/Network Attached Storage (NAS), and Internet Service Provider (ISP) in the private sector. Other customers can use the products to build high-reliability ring and meshed networks that Access Optical asserts are "ultra secure." The company also notes that its AΩ solutions can result in a 30- to 50-percent reduction in the customer network architecture hierarchy, eliminating multiple vendors, equipment, protocol integration, and reducing operations, administration, maintenance, and provisioning (OAM&P).

Access Optical maintains that the AΩ products will provide protocol scalability that will integrate easily within existing communication networks, while off-loading the computing resources vital to applications and mission-critical functions. This is especially important, as all communications—Earth or space—need to have common high-speed systems that are extremely secure and scalable.

The test bed research performed with NASA has additionally led Access Optical to develop a second product line called the Sigma-Epsilon (ΣE) Bridge. The soon-to-be-available technology could extend a LAN's topology to multiple geographic sites through a direct connection to WAN or metropolitan area network (MAN) optical transport networks. By providing a LAN this direct optical connection, bandwidth could be increased and transport network costs could be reduced. ❖